Project Management Development Process Status Report

Response to NIAT Action Item 2.1A

NASA Academy of Program and Project Leadership

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January 2002

Executive Overview

Background

NASA has historically made program and project management the focus of its approach to completing complex, multifaceted, and highly technical missions. Borrowing concepts of program/project management from the military in the late 1950s, NASA recognized that having an effective project management workforce was critical to the undertakings of the Agency (NASA, 1994). From the beginning, project managers were tapped to direct the day-to-day work on NASA's missions and were responsible for overall mission success. Although most of NASA's first project managers were scientists, NASA began placing engineers in these positions on many of the earliest missions (Naugle, 1991).

In 1993, NASA commissioned an extensive study aimed at developing a career model for project managers. The study documented knowledge, skills, abilities and experiences necessary for project management success in the NASA environment, and outlined training and development experiences useful for project managers, and for those individuals aspiring to become project managers. The study also identified the typical career paths of NASA project managers that followed a course of four levels or "stages." The study also produced recommendations for the types and sequence of job positions and experiences appropriate to develop project managers at the different stages or levels.

Subsequently, conclusions derived from the study were used to drive the development and refinement of NASA's project manager career development process, as well as the training opportunities and experiences offered through PPMI. The resulting PMDP Version 3.0 career development model focused on four career levels, reflecting increased responsibilities and performance expectations as employees develop in their careers. Guided by an Individual Development Plan (IDP) and documentation in a Record of Accomplishment (RoA), the individual pursued an individualized process for preparation as a project manager under the guidance and direction of their supervisor or a mentor. In collaboration with APPL, a Center recognized an employee's accomplishment of activities leading to completion of a program/project career level by issuing a *certificate* acknowledging completion from the Academy. It is important to remember that the PMDP has existed as a completely *voluntary* program from its inception.

Methodology for PMDP Version 4 Update

In response to mission problems and failures that were the subject of the NIAT Report, APPL completed a thorough review of the PMDP in 2001 focusing on improving the effectiveness of the development process. Although PMDP Version 3.0 provided a good framework for career development of NASA's program and project managers, the "roadmap" for moving along the career path was found to be confusing. Further, while PMDP Version 3.0 outlined actions that NASA's project staff should engage in to build competence in program and project management, including APPL coursework and other on-the-job experiences, it did not provide clear statements of the knowledge, skills and abilities prospective program/project managers must attain in order to be competent to perform at a desired level of management. In

addressing redesign requirements, APPL determined that the new Version of PMDP should transition to a performance-based format. The design requirements were:

- Be responsive to the changed/changing project management environment of NASA.
- Provide an accurate representation of competencies required for project management at NASA.
- Establish NASA-wide program/project management standards.
- Provide a roadmap for PM development that is easy to follow and understand.
- Be customizable to Center needs and requirements.
- Establish a consistent process for certification.
- Be adaptable to individual needs and individual differences and lead to an individualized process.
- Be flexible to implement.
- Drive all NASA APPL curriculum design and development products and services.

Subsequent to an extensive review and redesign process conducted from January through March 2001, the Academy drafted PMDP Version 4.0 for initial review across the Agency. For the first time, Version 4.0 detailed a set of specific competencies for all four levels of program/project management performance at NASA. The revised process also included provisions for establishing NASA standards and criteria for attaining competence across all areas and levels of project management development. PMDP Version 4.0 competency statements were developed from extensive study of the performance requirements and demands of NASA's program and project managers, including input and feedback from some of NASA's most accomplished managers, as well as experts from outside the agency. Like the previous version, Version 4.0 was developed around *ten* program/project management *job performance areas* under which *project leadership performance goals* were defined. Specific competency statements were developed for the four career levels as *strands* under each performance goal.

A critical feature of the PMDP Version 4.0 is that the process is *performance-based*. All the competencies are linked to knowledge, skills or abilities that are essential to perform effectively as a project leader in the job performance areas. Equally important, the individual determines, in consultation with a supervisor or mentor, an individualized process of coursework, other specific learning experiences and documented performance that will be employed to gain the competencies required. The *ten* performance areas of PMDP Version 4.0 are:

- ***Working in the NASA environment*** to achieve goals and continuously improve.
- ***Managing and developing people*** to inspire enthusiasm and improve performance.
- ***Working with teams*** to foster harmonious effort toward common goals.
- ***Formulating project concepts and plans*** to accomplish mission objectives or technology goals.
- ***Implementing programs and projects*** to produce products and services that meet customer expectations.

- ***Managing risk, safety and IT security*** to balance and reduce threats to project success.
- ***Managing and maintaining resources*** to attain program/project success.
- ***Administering and managing acquisition instruments*** to ensure timely and cost-effective delivery of specified services and products.
- ***Working across organizational boundaries*** to facilitate collaboration of diverse interests and cultures.
- ***Growing individually and professionally*** to become a better program or project leader.

Following the redesign of the PMDP, APPL has completed a thorough review of its flagship program/project management courses (Project Management, Advanced Project Management, Program Management) to ensure that coursework and other learning experiences are aligned with the PMDP competencies. This process is now continuing course by course. With input from the APPL Curriculum Advisory and Review Team (CART), this review has included a "gap analysis" to determine where the coursework and other learning experiences need to be revised, redesigned, or developed in relationship to the competencies. Additionally, APPL has re-evaluated the course requirements and prerequisites for each PMDP level, and evaluated the IDP process to ensure the revised PMDP Version 4.0 provides a clear and understandable career path for NASA program and project managers.

The NIAT Report specifies that NASA will designate the PMDP as the *Agency-wide* standard for program and project management professional competency and use them as considerations for selection, training, and assessment of key project personnel. The current process was simultaneously reviewed and upgraded as the content of PMDP was updated. Centers will analyze and assess the benefits of establishing more Center-specific PMDP competencies that complement and offer more specificity than the Agency-level process. The NIAT Report also points out that providing development and proactive support to employees is essential to the sustainability of NASA's excellent capability. At the core of this is challenging work that provides opportunities to develop relevant skills, adequate training, and a safe and healthy work environment. The success of NASA depends on having a knowledgeable and skilled workforce, supported by clearly understood processes and methodologies, and armed with tools that leverage emerging technology to simplify and improve design, development, and verification related engineering approaches. An example of initiatives that allow for preparation for increased challenges within the Agency is the PMDP Accelerating Leadership Option (ALO), where the best and brightest complete coursework at the Massachusetts Institute of Technology while preparing for NASA challenges. PMDP directly supports NASA's policy to:

- Use on-the-job work experiences as the primary method of developing the job-related knowledge, skills, and abilities of employees.
- Support systematic plans to broaden employees' knowledge and skills through planned, work-related developmental assignments including "on-the-job" training, rotational assignments, and non-NASA work experiences.
- Use formal training and educational experiences to complement work experiences.

- Require program/project managers as well as program/project personnel to have an annual minimum of 40 hours of project management-related learning and strongly encourage them to participate in at least another 40 hours of general learning each year.
- Support employee training, retraining, and organizational development activities leading to better ways of delivering services, improving work performance, and increasing the value of employee contributions to current and future Agency missions.

During September-December 2001, NASA Academy fielded the draft PMDP Version 4.0 to the functional offices, Centers, and Systems Management Offices to finalize design requirements and comments on the updated model, and to move towards the desired goal of creating effective online tools based on the printed materials that assist NASA personnel to access additional resources and provide online capabilities to manage their career development process and materials. Personnel that participated in the final review are listed in Appendix 1, and include functional subject matter experts, representatives from the Systems Management Offices (SMOs), and Center Training and Development representatives. Letters were sent to the review participants outlining the following instructions:

- Review each of the individual competencies for Levels 1, 2, 3, and 4 under each identified Job Performance Area with its associated Performance Goal, and recommend a minimum requirement and source (course, training, website, etc.) that should be implemented to achieve that specific Competency.
- Review the NASA PMDP Handbook and submit comments on the PMDP process for purposes of completeness, accuracy, and clarity.
- Review the NASA PMDP Handbook Competency Worksheets and submit comments on their use for tracking purposes.

The comments and suggestions that were returned are available in Table 2 of this report. The comments were analyzed and categorized into the following areas:

- Missing competencies and information.
- User-friendliness and format issues.
- Policy issues.
- Other issues.

The redesigned PMDP Version 4.0 now provides the competencies that can form the basis for a formal NASA project manage certification program. APPL also has in place an established curriculum that provides the training and directs other learning experiences necessary to attain the competencies. Therefore, if NASA chooses to proceed with a formal certification program, the process could begin at a very advanced stage. A suggested approach is included in the main document.

The results and recommendations of the previously accomplished *Benchmarking Study of PM Certification Programs* across the public and private sectors are remarkably consistent with the PMDP update activities. Study respondents emphasized that the decision to go ahead with a

formal certification program based on a set of specific competencies for a large, complex organization like NASA, IBM or Motorola is a major, serious decision in the history and culture of the organization. For certification to be successfully implemented and achieve the desired results, corporate or agency leadership must be ready to invest substantial time and money and lead a process of culture change. Substantial resistance must be expected, and leaders must have clearly in mind both the agency problem that formal certification will solve and how certification is likely to change the agency and its culture.

Recommendations

Option 1:

Maintain status quo through continuation of the current voluntary status and structure of PMDP Version 4. The model will remain as only one way to develop PMs in NASA. Coordination for updates and assistance in usage of the materials will continue at present levels, and usage and documentation will remain at the discretion of the individual participant.

Advantages:

1. No additional resource requirements.

This approach will allow NASA to accomplish voluntary compliance with the requirements generated in the PMDP.

2. Limits requirements on the project workforce.

Any approach toward certification using the PMDP model will require at least some individual effort. People will continue to need the time to document work experiences. Centers will need to establish time to review, assess, recommend and develop development strategies to map capability. However, there will be no requirements, so there will be no pressure.

3. No expectations to manage.

In a system without requirements and discipline, there is no standard to meet. The PMDP will remain as a voluntary program, and managers do not need to worry about managing employee expectations or requirements generated from project management career development issues.

4. No impact on selections for NASA programs and projects.

Managers will continue to be unconstrained in their selection of project managers or other project personnel. The PMDP will not provide mandatory input into this process.

Weaknesses:

1. Lack of discipline

The greatest potential weakness of the current developmental system is that there are no agency standards applied to the selection and development of project managers using a standard Agency-wide approach. In an organization that spends billions of taxpayer dollars through the management of projects NASA's unsystematic approach can create the appearance of a significant problem. Beyond the appearance issues, the lack of discipline may result in selecting project managers who are unprepared in the methodology of project management, e.g. risk management, cost management, planning and scheduling. The lack of discipline to a defined process and model also prevents employees from clearly understanding what is expected of them if they want to be a project manager.

2. Ignores public reports

In two of the four recent failure reports, findings encouraged NASA to consider some form of project manager certification. PMDP provides the infrastructure, but needs support and buy-in. Maintenance of the current approach ignores these recommendations. Furthermore, it is likely that future committee reports will continue to recommend some form of certification.

3. Lack of driving force for improvement

This approach maintains the status quo and does not introduce a driving force for improvement in terms of project performance and project manager capability. All of the organizations in this benchmarking study are moving towards or already possess a mandatory and formal PM development and certification process. NASA is already halfway there with a robust PMDP model. The Benchmarking Study results reflect the fact that organizations make a conscious effort to improve in terms of project management capability, and that decision requires a commitment by the entire organization, not individual units or sectors.

4. Lack of agency integration and coordination

The lack of a disciplined agency approach using PMDP as a foundation to certification will further encourage development of a disparate array of options used at the field center level. Continued divergence of Center approaches can undermine agency direction and waste resources through uncoordinated investment in capability development.

5. Inability to manage a critical community

The lack of recognized agency competency standards as reflected in the PMDP for the project management community may suggest an inability to collaboratively determine and manage requirements and standards.

Option 2:

Establish and aggressively promote the PMDP as the preferred NASA approach, with a final tailoring effort aimed at the Centers, functional offices, and SMOs, with a formal PMDP roll-out process implemented at the conclusion of the final update. Incorporate and promote PMDP certification as a desirable, but not mandatory, basis for selection.

Advantages:

1. Evolution of current process.

The current NASA PMDP is robust and strong. The weakness of the current system is based mostly on the lack of management emphasis and utilization of existing resources. A strong link between development and management direction would largely accomplish the benefits of full certification using the PMDP as the foundation. These revised PMDP competencies and upgraded courses lend themselves to voluntary use in selections and individual performance plans. NASA could elect to gradually incorporate these elements into existing management practices, avoiding the inevitable differences of opinion.

2. Limited additional resources

Since the majority of costs to develop the career model and curriculum are sunk costs that are currently covered through the NASA Academy of Program Project Leadership (APPL), emphasis on the implementation of voluntary certification using the PMDP would limit the additional investments. Increased participation in the voluntary PMDP certification would, however, require additional investments in mentoring, administering, on the job training, and attendance of formal development events.

3. Limits resistance.

An evolutionary, voluntary PMDP certification approach would significantly eliminate resistance to change.

4. Builds on current grassroots support

This approach builds on the current community of project practitioners who have received certification through the PMDP. A recent focus group of senior agency project practitioners strongly expressed the opinion that certification or training was necessary but not sufficient criteria for selection of project managers.

5. Establishes and promotes project manager certification consistent with industry trends

The informal approach for PMDP relies on an evolutionary model for achieving broad certification. Over a period of time it is expected that a significant percentage of practitioners would be certified and the culture will enforce broader certification. NASA

will come into alignment with many industry and government organizations that promote project management certification.

Weaknesses:

1. Potential for uneven implementation to reduce the effectiveness of certification.

Some individuals (as is currently the case) will significantly benefit from planned work experiences and development using the PMDP, while others will be told to forget about it and just do their jobs. Realization of the benefits of workforce development will continue to be a function of where one works and for whom one works, and the level of understanding that personnel possess of the PMDP.

2. Extends time by relying on management support and grassroots effort.

The evolutionary approach will take longer to achieve, if NASA is serious about PM certification using the PMDP. In our culture it is unlikely that all managers will be capable and/or motivated to support such a strategy. This will once again place the demand on the workforce to implement leader direction. Such an approach would work effectively only if Enterprise leaders and Center Directors are strongly supportive of using the PMDP.

3. Continues perceived void of leadership direction and failure to learn from past mistakes.

An evolutionary approach to project manager certification will be criticized in some quarters as indicating a lack of ability to make a definitive decision on PMDP certification and unwillingness to learn from past failures.

Option 3:

Develop and implement a NASA-mandated PMDP certification system, with specific requirements, standardized tools and techniques, and a centralized database of certified Project Managers that are to be used in selecting program or project managers, according to defined scope and resource allocation criteria. This program would be implemented within the time span of a mandatory transition window. Final tailored adjustments would be made to the PMDP model for each Center covering functional office requirements and selections to programs and projects would not be made without PMDP certification.

Advantages:

1. Establishes unambiguous support for PMDP certification.

This approach maintains a level of consistency across NASA programs and projects, while addressing specific interests. As a result, this encourages buy-in to the PMDP certification activities by elements that have consistently perceived themselves as separate and distinct units.

2. Establishes NASA rigor and discipline.

A formal PMDP certification process will answer specifically what is expected of individuals who become project managers. Such an option would ensure at least minimal experience and educational standards for a workforce that is responsible for the majority of NASA's budget.

3. Consistent with external organizational trends.

As stated within the formal report, organizations that depend on project management are increasingly establishing standards associated with certification. The NASA PMDP model provides for a very effective system to manage the project management workforce. It is increasingly common for organizations to require certification before an individual can be selected to a position.

4. Addresses external expectations related to NASA project management

NASA is considered one of the preeminent project organizations in the world. It is likely that there will be continuing pressures to ensure that NASA has a form of certification. In the event that NASA maintains the status quo the probability is high that NASA will eventually be forced into an externally mandated approach different than the PMDP.

Weaknesses:

1. Will require significant additional resources.

This approach takes time to work with each major internal stakeholder on developing a tailored PMDP model that will meet NASA requirements while addressing specific interests. Demand for required training and development experiences can be expected to increase, in some locations to a great degree. The results of this study indicate that this is the approach the majority of organizations implemented or desire to implement, but the time and effort expended are significant for NASA. This approach also requires visible senior leadership emphasis and support in order to succeed.

2. Resistance will be greatest in this option.

Based on the discipline of this approach, it is likely to produce the greatest opposition. It will require the greatest change from the NASA norm. The introduction of mandatory criteria will necessarily limit management flexibility in selections. Many Centers have already begun or are thinking about developing their own competency models, independent of an overall Agency approach.

3. Demands addressing the issue of "grandfathering"

As has been pointed out throughout this report, a consistent finding has been the problems regarding "grandfathering" of experience and relating this to the PMDP benchmarks. Most organizations that established certification requirements indicated "grandfathering" was a mistake and should be avoided. Nonetheless, some process would need to be in place to accommodate the advanced experience level of many NASA practitioners so that they are placed at the appropriate level in the PMDP.

4. Danger of "box-checking" mentality

A formal certification process using the PMDP is likely to create the potential for practitioners becoming more concerned with checking the box than with their professional development and preparation. There is a danger that the quality of development experience will fall victim to the quantity as demand for this experience grows. PMDP certification would have to be seen as a necessary but not sufficient form of capability.

5. Consideration would have to be given to potential legal and union issues.

It is critical to understand that an intensive effort and acceleration of current Academy activities will be required for *options 2 and 3*. These accelerated activities include:

- Development of a total systems approach to an online PMDP capability, to include online availability of job aids, an online expert system that guides users to appropriate PMDP content, and an online database of PMDP participants that outlines achievement and capabilities towards selection as program and project managers.
- Development of minimum requirements and equivalencies for each identified PMDP competency at each Center.
- Requires managers to create work positions to provide on-the-job experiences to support desired PMDP capabilities.
- Requires Enterprises to address and specify the desired number of PMDP-certified people in the requirements of new programs and projects.
- Requires the development and implementation of a more rigorous coaching and mentoring system at each Center to support PMDP activities.
- Positions will need to be competitively advertised, and PMDP certification requirements will need to be explicit.
- Consultation and tailoring of PMDP Version 4 will need to occur at Centers to ensure that competency models reflect unique capabilities and opportunities.
- Final buy-in and agreement on format and content, with a scheduled rollout and visible leadership emphasis and support.

Introduction

Competency Overview and Background

Career development and learning technologies have advanced significantly since the days of simply providing training courses to address workforce deficiencies. The competency approach is currently the standard that is applied to the vast majority of workforce development models in the public and private sector, and is endorsed by the Office of Personnel Management (OPM) as the preferred method for workforce development and career development issues for Federal agencies.

The terms *competency*, *standards* and *criteria* are often used in determining the qualifications and requirements for certifying professional groups. Competencies are statements of specific knowledge, skills, abilities, characteristics, attitudes and behaviors that enhance job performance for particular roles within an organization (Lucia and Lepsinger, 1999). A central meaning of a standard is a point of reference against which individuals, organizations, products and processes are compared and evaluated. Additionally, *process standards* provide guidance about the knowledge, tools and techniques that are useful in the practice of the profession (Cabanis, 1999). Standards, therefore, describe the conditions under which the competencies are performed, and the criteria that define the actions or outcomes required for the performance to be considered "to standard" (Hale, 2000).

An effectively designed competency development process includes identifying top performers and determining what they do and how they do it by identifying factors that lead to superior performance. The most useful models are customized for individual divisions and roles within the greater organization (Hale, 2000). Tailoring competency models for organizations can have a variety of scopes, with some models identifying core competencies required for all levels of a workforce, and other models focusing more on developing competencies for a specific unit, type of job or position, such as programmers working in IT. The development and management of competencies involves:

- Accurately identifying specific competencies for individual roles at different levels.
- Assessing individuals according to the requisite competencies for their position.
- Providing tools to refine further professional capabilities based on individual staff assessments.

In industry, organizations that manage the development of capabilities of their managers through competencies gain critical competitive advantage in business processes such as recruiting, retaining, and motivating high-performers (Lucia and Lepsinger, 1999). Competency models address such business needs as clarifying job and work expectations, maximizing productivity, enhancing feedback processes, allowing the organization to adapt to change, and aligning individual and team behaviors with organization strategies and values. Holtzman (1999) points out that, "by establishing proven and accepted standards today, project management professionals can be better prepared for the challenges of the future."

Lucia and Lepsinger (1999) point out that a natural progression from the development of an accurate and valid competency model is to assess employees according to the requisite competencies for their specific job position, and provide tools to develop professional capabilities based on employee assessments. Hale (2000) differentiates three models for developing and assessing competency:

- **Knowledge-based:** Knows the terms, rules, principles, concepts and procedures, and demonstrates this knowledge in a testing situation.
- **Skill-based:** Can apply the terms, rules, principles, concepts and procedures under controlled conditions, such as simulations.
- **Performance-based:** Can apply the terms, rules, principles, concepts and procedures consistently under real working conditions.

A competency-based framework is the backbone of an effective project manager development and certification program (Crawford, 1999). In developing competencies for project managers the application of external project management standards must be placed into an organization's specific context if the potential benefits of assessment, certification, and ongoing development are to be realized. Crawford (1999) makes the case that assessment links learning outcomes with learning objectives in a meaningful way. She identifies several standards against which assessment can be made, including the PMBOK, the International Project Management Association (IPMA) Competence Baseline, and the Australian National Competency Standards for Project Management. Crawford notes, however, that there are several problems with these external standards of certification, such as:

- They tend to be based on a static interpretation of the past, neglecting continuing professional development;
- The standards tend to be generic and do not capture the complexities and variations of specific project environments; and
- Personality and attitude components may be de-emphasized or neglected.

NASA and Workforce Development

NASA has always made program and project management the focus of its approach to completing complex, multifaceted and highly technical missions. Borrowing concepts of program/project management from the military in the late 1950's, NASA recognized that having an effective project management workforce was critical to the undertakings of the Agency (NASA, 1994). From the beginning, project managers were tapped to direct the day-to-day work on NASA's missions and were responsible for overall mission success. Although most of NASA's first project managers were scientists, NASA began placing engineers in these positions on many of the earliest missions (Naugle, 1991).

Support requirements for a project-based workforce evolved as technology became more sophisticated and career development processes and procedures matured. The current NASA Academy of Program and Project Leadership (APPL) has existed in earlier incarnations since

1987. Originally, it was titled the Program and Project Management Initiative (PPMI) and was established as one solution to address concerns in the post-*Challenger* NASA. The *Challenger* tragedy was a watershed event for NASA, channeling enormous energy and thought towards understanding what went wrong and how to repair the NASA legacy of project excellence. Numerous tiger teams, commissions, and boards originated with the single task of improving NASA project management. Out of this climate of introspection and commitment was conceived the notion of a Program and Project Management Initiative (PPMI), the precursor of NASA APPL. The Initiative was sponsored by then Deputy Administrator J.R. Thompson, who assigned an initial $2 million training budget with one full time civil service employee. The mission of this entity was to promote project management excellence and capability in advance of NASA's needs through training and development services.

The early years of PPMI were focused on establishing a robust and relevant curriculum of courses to provide sound fundamental skills for the workforce, with progressive incremental improvements in capability through progressive challenging work assignments and mentoring by an established cadre of successful practitioners. Training would only represent a fraction of the performance equation, perhaps ten percent. The bulk of preparation resided in the time and duration to gain professional experience in the real world of projects, with an essential reliance on a previous generation of project talent serving as mentors, coaches and expert guides.

This approach suited NASA in 1990, since the organization was still a leader in managing large, expensive, long duration programs and projects. The history of Apollo, Shuttle, Viking, and the Hubble Space Telescope offered technologically challenging programs that allowed for a progression of learning in a more deliberate and hierarchical context. The Initiative provided a sound foundation for preparation of project management capability, while individuals could expect the time to learn and fine-tune expertise in a work setting loaded with experienced professionals. In an environment of a few very large Programs, with an abundance of project expertise cultivated through the challenges of Apollo and Shuttle, such a strategy was both logical and desirable.

The *second generation* of NASA Academy started in 1992 with the appointment of Dan Goldin as NASA administrator. Mr. Goldin initiated a dramatic remodeling of NASA program and project management. The era of managing projects that were Faster, Better, Cheaper (FBC) was established. The emphasis was on doing more with less, greatly increasing the volume of project work and doing it in a way that emphasized safety, innovation, low cost, speed, and quality. This vision dramatically altered the nature of project management and the way talent would be developed, and was a reaction to the political realities of the time. The downsizing and budgetary pressures that resulted from mandates by the Executive Branch and Congress had severely affected operational effectiveness and employee working conditions in NASA. Additionally, the pace of technology had driven NASA (as well as the rest of the government) into a competitive environment for talent in which the private sector could offer significantly better rewards for technological capability. The rapid pace of technology flattened the NASA hierarchy and pushed information availability and access to the project team level, requiring strong project leadership skills to be demonstrated by all team members. NASA shifted to a technology-based organization, with information available to every employee. Project managers

had to be business people as well as technical experts for a project to succeed, requiring the learning of completely new skill sets in many instances.

To meet these challenges, the PPMI required significant modification to support this new vision of FBC. Courses without a clear link to mission success and requirements were now useless. The competency-driven approach was initiated, focusing on a formal career development strategy (eventually called the NASA Project Management Development Process, or PMDP) that was intended to link critical project competencies to NASA-sanctioned learning and education. Such a systematic analysis of curriculum content to organizational customer requirements created the first possibility to tie mission success to transfer of learning, thereby tying human resources directly to mission success. Once NASA personnel started to consider the competencies necessary to increase their capability, this led to requests for new courses, voluntary certification of learning and competency, on-line computer support, and requests for intact-project team performance support.

To support this transition in senior management strategy, the Administrator and Associate Administrators directed that the PPMI change to the NASA Academy of Program and Project Leadership (NASA APPL) in 1998 to act as a mechanism for change and as a sensing mechanism for what is working and what is not in the NASA project management arena through continuous conversations with NASA project managers in the field, (based on the Crotonville model for Jack Welch in General Electric). The mission of NASA APPL evolved to providing total team and individual professional development support through training, developmental activities and tools for the organizational benefit of developing and maintaining world-class practitioners of project management in advance of NASA's requirements. The key element of the Academy approach is the voluntary Project Management Development Process (PMDP) that emphasizes the practitioner aspect of developmental activities supplemented by academic materials. This model provides the basis and benchmark for PM career development within NASA, and has been borrowed by several public and private organizations as a best practice. The Academy maintains close coordination with the NASA Engineering Training program (NET) that addresses the improvement of engineering technical capability, a competency that is closely related to the project management emphasis of the Academy. Together, these efforts have continued to ensure that NASA develops engineering talent in advance of Agency need.

The Genesis of PMDP

In 1993, NASA commissioned an extensive study aimed at developing a career model for project managers. The study documented knowledge, skills, abilities and experiences necessary for project management success in the NASA environment, and outlined training and development experiences useful for project managers, and for those individuals aspiring to become project managers. The study also identified the typical career paths of NASA project managers that followed a course of four levels or "stages." These stages included:

- Stage 1: G*etting Established* (e.g., project team member)
- Stage 2: *Independent Contributor* (e.g., subsystem project manager)
- Stage 3: *Technical Lead/Manager* (e.g., system project manager)

- Stage 4: *Organizational Sponsor* (e.g., program manager)

The study also produced recommendations for the types and sequence of job positions and experiences appropriate to develop project managers at the different stages or levels. Subsequently, conclusions derived from the study were used to drive the development and refinement of NASA's project manager career development process, as well as the training opportunities and experiences offered through PPMI. The study's conclusions about project management career development at NASA included (NASA, 1993):

- On-the-job experience, especially hands-on hardware experience, is vital early in the individual's career;
- Diversity of project experiences and assignments is necessary to prepare the project manager to serve as a "broad generalist;"
- Developing project managers should take advantage of formal training courses to learn basic skills that complement on-the-job training, and prepare them for the next career position; and
- Interpersonal skills are just as important as technical skills for project success. A project manager's ability to manage a team and effectively communicate with key players is critical to dealing with inevitable conflicts arising on highly complex projects.

The new FBC era for NASA projects in the 1990's placed an emphasis on doing more with less – greatly increasing the volume of project work --- and doing it in a way that emphasized safety, innovation, low cost, speed, and quality. As a result, it was no longer reasonable to generate coursework and other learning experiences without a clear link to factors associated with mission success and requirements. A major effort was undertaken to identify the core competencies required for success at different stages of a project manager's career.

Using the results of the 1993 study, an individualized approach was developed in preparing project managers centering on a formal career development strategy linking critical project competencies to NASA-sanctioned learning and education. This was the first time NASA had conducted a systematic analysis of project management requirements and curriculum content that allowed human resources and learning experiences to be tied directly to mission success. This voluntary project management training approach eventually became known as the NASA Project Management Development Process, or PMDP. In 1995, after gaining additional input from NASA's functional organizations and training officers to validate the content and approach, PMDP Version 2.0 was released.

Throughout the rest of the 1990s, significant changes affecting the NASA project management environment continued to have an impact on the Agency's ability to prepare project managers. Factors such as shrinking budgets, downsizing the civil service workforce, instituting ISO 9000+ quality standards, implementing "faster, better, cheaper" strategic management, responding to GPRA, and establishing new guidelines and policies for program/project management (i.e., NPG 7120.5A), drove efforts to find improved methods to shape project management competencies to meet the changing demands.

In 1999, APPL produced PMDP Version 3.0. This version was developed with significant input from NASA's functional organizations and the Program Management Council Working Group (PMCWG). It also incorporated processes and requirements established in the newly revised NASA Procedures and Guidelines for program and project management (NPG 7120.5A), and included the results of an assessment of program management knowledge, skills and abilities generated from a focus group of senior NASA program managers using a formal curriculum development method called DACUM. With this revision of the PMDP, APPL fine-tuned a process for preparing program and project managers that was designed to:

- Expand the core competencies and skills of people in projects.
- Advance the implementation of NASA's strategic mission.
- Promote superior project management practices in advance of need.
- Provide a NASA-wide development process for people managing projects.
- Offer clear information about professional development in program/project management.
- Provide a point of comparison with other organizations' project management approaches.
- Provide recognition of employee maturity and professionalism.
- Implement with employee-supervisor responsibility (voluntary, Center-managed).
- Document skills and experiences.

The resulting PMDP Version 3.0 career development model focused on four career levels, reflecting increased responsibilities and performance expectations as employees develop in their careers. Guided by an Individual Development Plan (IDP) and documentation in a Record of Accomplishment (RoA), the individual pursued an individualized process for preparation as a project manager under the guidance and direction of their supervisor or a mentor. In collaboration with APPL, a Center recognized an employee's accomplishment of activities leading to completion of a program/project career level by issuing a *certificate* acknowledging completion. The following career levels were outlined in the PMDP process:

- **Level 1**

  Objective: Prepares participants to operate effectively as team members in a project environment

  Target Audience: Individuals entering the project environment and operating as a team member

- **Level 2**

  Objective: Prepares participant to operate effectively as a subsystem or-sub-component team lead operating in a larger system or project environment

  Target Audience: Individuals preparing to lead a team of a subsystem or sub-component operating in a larger system or project environment

- **Level 3**

Objective: Prepares participants to operate effectively as a project manager over complex systems

Target Audience: Individuals preparing for a position as a professional project manager over a complex system with multiple components

- **Level 4**

  Objective: Prepares participant to operate as a program manager over multiple projects involving complex systems or over a high-visibility agency project

  Target Audience: Individuals preparing to manage a program involving multiple projects or a major project

From the start, the PMDP was set up as a voluntary process managed at the Center level. Implementation of the PMDP by Centers was entirely discretionary. Review and validation of Levels 1 and 2 accomplishments was vested in an employee's supervisor or manager. However, a formal Center PMDP Board review and approval was required for approval of Levels 3 and 4. Therefore, an employee could not receive a certificate of accomplishment for Levels 3 or 4 unless a Center established a formal PMDP review board process.

PMDP Update Methodology

In response to mission problems and failures that were the subject of the NIAT Report, APPL completed a thorough review of the PMDP in 2001 focusing on improving the effectiveness of the development process. Although PMDP Version 3.0 provided a good framework for career development of NASA's program and project managers, the "roadmap" for moving along the career path was found to be confusing. Further, while PMDP Version 3.0 outlined actions that NASA's project staff should engage in to build competence in program and project management, including APPL coursework and other on-the-job experiences, it did not provide clear statements of the knowledge, skills and abilities prospective program/project managers must attain in order to be competent to perform at a desired level of management. In addressing redesign requirements, APPL determined that the PMDP must:

- Be responsive to the changed/changing project management environment of NASA.
- Provide an accurate representation of competencies required for project management at NASA.
- Establish NASA-wide program/project management standards.
- Provide a roadmap for PM development that is easy to follow and understand.
- Be customizable to Center needs and requirements.
- Establish a consistent process for certification.
- Be adaptable to individual needs and individual differences and lead to an individualized process.
- Be flexible to implement; and Drive APPL curriculum design and development.

Subsequent to an extensive review and redesign process conducted from January through March 2001, APPL drafted PMDP Version 4.0 for initial review across the Agency. For the first time, Version 4.0 detailed a set of specific competencies for all four levels of program/project management performance at NASA. The revised process also included provisions for establishing NASA standards and criteria for attaining competence across all areas and levels of project management development. PMDP Version 4.0 competency statements were developed from extensive study of the performance requirements and demands of NASA's program and project managers, including input and feedback from some of NASA's most accomplished managers, as well as experts from outside the agency. Like the previous version, Version 4.0 was developed around ten program/project management *job performance areas* under which *project leadership performance goals* were defined. Specific competency statements were developed for the four career levels as *strands* under each performance goal. Figure 1 illustrates the format of the PMDP Version 4.0 approach:

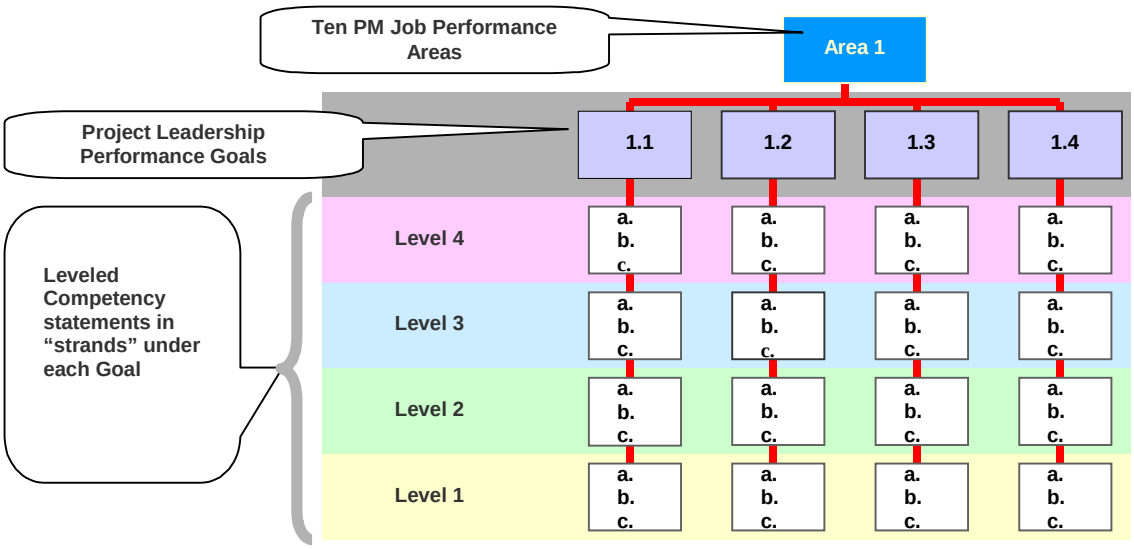

Figure 1: PMDP Version 4.0 Format

A critical feature of the PMDP Version 4.0 is that the process is *performance-based*. All the competencies are linked to knowledge, skills or abilities that are essential to perform effectively as a project leader in the job performance areas. Equally important, the individual determines, in consultation with a supervisor or mentor, an individualized process of coursework, other specific learning experiences and documented performance that will be employed to gain the competencies required. The ten performance areas of PMDP Version 4.0 are:

- ***Working in the NASA environment*** to achieve goals and continuously improve.
- ***Managing and developing people*** to inspire enthusiasm and improve performance.
- ***Working with teams*** to foster harmonious effort toward common goals.
- ***Formulating project concepts and plans*** to accomplish mission objectives or technology goals.

- ***Implementing programs and projects*** to produce products and services that meet customer expectations.
- ***Managing risk, safety and IT security*** to balance and reduce threats to project success.
- ***Managing and maintaining resources*** to attain program/project success.
- ***Administering and managing acquisition instruments*** to ensure timely and cost-effective delivery of specified services and products.
- ***Working across organizational boundaries*** to facilitate collaboration of diverse interests and cultures.
- ***Growing individually and professionally*** to become a better program or project leader.

Subsequent to revising the PMDP, APPL has completed a thorough review of its program/project management curriculum to ensure that coursework and other learning experiences are aligned with the PMDP competencies. With input from the APPL Curriculum Advisory and Review Team (CART), this review has included a "gap analysis" to determine where the coursework and other learning experiences need to be revised, redesigned, or developed in relationship to the competencies. Additionally, APPL has re-evaluated the course requirements and prerequisites for each PMDP level, and evaluated the IDP process to ensure the revised PMDP Version 4.0 provides a clear and understandable career path for NASA program and project managers.

APPL also established the PMDP Accelerated Leadership Option (PMDP-ALO) in partnership with the Massachusetts Institute of Technology in response to senior management desires for an accelerated developmental program for top performers. The purpose of the PMDP-ALO is to prepare NASA's "best and brightest" candidates for leadership of NASA's technical programs/projects. Participants receive a MIT Masters degree in Engineering and Management offered from the System Design and Management program and a certificate in NASA PMDP Level III or IV. This option requires significant distance learning and residency components and is available to all Centers and Headquarters. The content focuses on the practitioner, and provides opportunities to network with professionals from aerospace and other industries. Elements of the program cover safety and risk from a systems perspective, with optional tracks that include information technology and software engineering. The key components of the program focus on system design, product development, business management and leadership, and information technology. Project managers completing the program may serve as APPL instructors and mentors upon completion of current projects, and receive an assignment with APPL targeted at sharing expertise in terms of project management, functional skills, science and engineering. These PMDP-ALO project leaders will be used to improve the delivery of performance support initiatives across the Agency, focusing on project management, functional and technical excellence capabilities on the part of the assigned instructors.

The NIAT Report specifically specifies that NASA will designate the PMDP as the Agency-wide standard for program and project management professional competency and use them as considerations for selection, training, and assessment of key project personnel. The current process will simultaneously be reviewed and upgraded. Centers will analyze and assess

the benefits of establishing more Center-specific PMDP competencies that complement and offer more specificity than the Agency-level process.

The NIAT Report also points out that providing development and proactive support to employees is essential to the sustainability of NASA's excellent capability. At the core of this is challenging work that provides opportunities to develop relevant skills, adequate training, and a safe and healthy work environment. The success of NASA depends on having a knowledgeable and skilled workforce, supported by clearly understood processes and methodologies, and armed with tools that leverage emerging technology to simplify and improve design, development, and verification related engineering approaches.

To support the full utilization of the workforce in achieving strategic outcomes, it is established NASA policy to make training and developmental opportunities widely available to employees to enhance individual capabilities, build and retain a skilled and effective workforce, improve organizational performance, and maintain scientific, professional, technical and management proficiency. To this end, PMDP is a central part of NASA's policy to:

- Use on-the-job work experiences as the primary method of developing the job-related knowledge, skills, and abilities of employees.
- Support systematic plans to broaden employees' knowledge and skills through planned, work-related developmental assignments including "on-the-job" training, rotational assignments, and non-NASA work experiences.
- Use formal training and educational experiences to complement work experiences.
- Require program/project managers as well as program/project personnel to have an annual minimum of 40 hours of project management-related learning and strongly encourage them to participate in at least another 40 hours of general learning each year.
- Support employee training, retraining, and organizational development activities leading to better ways of delivering services, improving work performance, and increasing the value of employee contributions to current and future Agency missions.

Table 1 provides a comparison of the areas of emphasis for the two most widely accepted competency models against the NASA PMDP Version 4 Career Development Model. The first column represents nine project management *knowledge areas* outlined in the PMI's (1996) *Project Management Body of Knowledge* (PMBOK). The PMBOK refers to the content of these areas as "generally accepted" knowledge and practices that are applicable to most projects most of the time, and that there is widespread consensus about their value and usefulness. PMI offers a Project Management Professional (PMP) certification that is based principally on the knowledge contained in the PMBOK. To achieve PMP certification, each candidate must satisfy all educational and experiential requirements established by PMI and must demonstrate an acceptable and valid level of understanding and knowledge about project management that is tested by the Project Management Professional Certification Examination. In addition, those who have been granted the PMP credential (certificants) must demonstrate ongoing professional

commitment to the field of project management by satisfying Professional Development Program requirements.

The middle column lists ten project management *skill areas* presented in Kerzner's (1998) text on *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*. The content of these areas include specific skills required to perform effectively in these areas, and the personal management traits underlying these skills "that operate to form a homogeneous management style." Although these skill areas are not linked to a certification process, the connections between knowledge and management styles and personal traits suggests that evidence of proficiency and mastery of these skills goes beyond tests of knowledge alone.

The final column provides NASA's ten PMDP Version 4.0 *job performance areas* contextualized to NASA's unique project management environment. Each area is broken down into *project leadership performance goals*, with specific competency statements developed by career level in *strands* under each goal. The PMDP provides performance standards and criteria for each competency to guide an individualized process for achieving, demonstrating and documenting the required knowledge, skills and abilities. NASA's PMDP competency model is performance-based, and requires each participant to design an individualized development process specifying learning experiences and activities for attaining and documenting capability.

Table 1: Comparison and Mapping of Competency Areas **PMBOK**	**Kerzner (1998)**	**NASA PMDP v 4.0 (2001)**
PM Knowledge Areas:	**PM Skill Areas:**	**PM Job Performance Areas:**
Project Integration Management	Team Building	Working in the NASA Environment
Project Scope Management	Leadership	Managing and Developing People
Project Time Management	Conflict Resolution	Working with Teams
Project Cost Management	Technical Expertise	Formulating Project Concepts and Plans
Project Quality Management	Planning	Implementing and Evaluating Programs and Projects
Project Human Resource Management	Organization	Managing Risk, Safety and IT Security
Project Communications Management	Entrepreneurship	Managing and Maintaining Resources
Project Risk Management	Administration	Administering and Managing Acquisition Instruments
Project Procurement Management	Management Support	Working Across Organizational Boundaries
	Resource Allocation	Growing Individually/Professionally

Final Design Review and Tailoring of PMDP V4

During September-December 2001, NASA Academy fielded the draft PMDP Version 4.0 to the functional offices, Centers, and Systems Management Offices to finalize design requirements and comments on the updated model, and to move towards the desired goal of creating effective online tools based on the printed materials that assist NASA personnel to

access additional resources and provide online capabilities to manage their career development process and materials. Personnel that participated in the final review are listed in Appendix 1. Letters were sent to the review participants outlining the following instructions:

- Review each of the individual competencies for Levels 1, 2, 3, and 4 under each identified Job Performance Area with its associated Performance Goal, and recommend a minimum requirement and source (course, training, website, etc.) that should be implemented to achieve that specific Competency.
    - For example, under the Job Performance Area of *Working in the NASA Environment to Achieve Goals and Continuously Improve*, start with the Performance Goal of *Knows NASA's organization.*…... and follow the line to Level 1 Competency A at the bottom of the chart, *Has a basic knowledge of how NASA is organized.…..;* suggest a minimum requirement that would achieve this competency, such as reading the strategic plan, talking with senior managers, taking a NASA training program, etc.
- Review the NASA PMDP Handbook policies and submit comments on the PMDP process for purposes of completeness, accuracy, and clarity.
- Review the NASA PMDP Handbook Competency Worksheets and submit comments on usage for tracking purposes.

The comments and suggestions that were returned are in Table 2. These comments have been consolidated to remove duplications and categorized as follows:

- Missing competencies and information.
- User-friendliness and format issues.
- Policy issues.
- Other issues.

It is important to note that several comments concerning design and format of existing materials is currently under review by NASA APPL and resolution of these comments may require further clarification at Center level.

Table 2 PMDP V4 Comments **Category**	**Comment**	**Resolution**
Missing or duplications	Level 1 Competencies 1.2 and 1.3 are identical and should not be.	Corrected in Chart to match Guide.
	Levels 2 and 3 Competencies for 1.1 do not take into account interaction above, only interaction downward.	Definitions added to address upward influence and coordination skills.
	Area 4 does not clarify importance of coordinating with managers of crosscutting products in program/project planning activities.	Competency added.
	Capability in planning products as incremental improvements vs. all-or-none approach needs to be added to Area 4.	Competency added.
	Minimum requirements to achieve stated desired capabilities are missing, and need to be developed for each individual competency.	Being developed.
	Develop a matrix of courses tied to competencies.	Being developed.

Table 2 PMDP V4 Comments **Category**	**Comment**	**Resolution**
User-friendliness/format	IDP forms in the PMDP Guide are not much use and are difficult to decipher.	Being reviewed.
	90 pages of checklists in the PMDP Guide are too much for NASA Managers to effectively use.	Being redesigned.
	Acronyms in the PMDP Wallchart need to be referenced.	Being developed.
	Clarify that Level 1 personnel participate in projects in a support capacity to the other levels.	Clarification added.
	Simplify and eliminate wordiness of original text.	Being reviewed by technical writer.
	Top-down presentation of Chart suggests implementation rather than participation.	Top-down presentation reinforces perception of climbing the career ladder: format maintained.
	Level 2 and 3 should be combined.	Level 2 and 3 are distinctly different, and will be maintained.
	Wallchart is too complex and intimidating.	Options being developed for Wallchart redesign.
	Text on PMDP Wallchart is too small.	Options being developed for Wallchart redesign.
	Need to have other forms for the materials rather than only electronic.	Paper materials will be distributed after final redesign.
	Materials are not designed from a user's perspective.	Options being developed for Wallchart redesign.

Table 2 PMDP V4 Comments **Category**	**Comment**	**Resolution**
User-friendliness/format	PMDP Guide mixes 2 different purposes of career development and PM certification, which should be addressed separately.	Clarification being developed.
	A flowchart needs to be developed covering the PMDP process.	Flowchart being developed.
	Example of a good portfolio, with pre-approved forms and checklists needs to be provided.	Example and materials being developed.
	Not clear what requirements in the Competency Worksheets need to be accomplished at what Level, or whether all Worksheet requirements would be applicable to all the performance goals.	Checklists being separated into Levels, with expanded explanation.
	The generic PMDP Wallchart needs to be tailored for each performance goal rather than being applied across-the-board.	Wallchart purpose is to present complete program in 1 job-aid. Online tools and Guide materials will break out to each performance goal.
	Need to include a comprehensive glossary in the PMDP Guide.	Being developed.

Table 2 PMDP V4 Comments **Category**	**Comment**	**Resolution**
Policy	Career paths in Section 4 of PMDP Guide not applicable in new NASA environment since nothing is "typical" anymore.	Inquiry made to PMCWG and EMC.
	Programs are not prevalent at Center level, possibly restricting number of personnel that can reach Level 4.	Inquiry made to PMCWG and EMC.
	Discussion on who pays for what in developmental assignments and rotational assignments needs to be discussed.	Program financials being clarified and will be included in the PMDP Guide.
	Model does not address Contractors as Team Members, particularly in Areas 2 and 3. NASA Managers as coaches, influencing behavior through rewards and penalties, and selecting contract staff in terms of desired skills is not addressed, as well as "insight vs. oversight" issues. Another element is selecting Contractors over Civil Servants and how much leeway is available.	Inquiry made to PMCWG and EMC.
	Greandfathering issues need to be clarified, and equivalencies for experience need to be more clearly addressed.	Requirements in terms of equivalencies being defined. Grandfathering will not be allowed per Benchmarking Study results.
	SMO needs to be represented on the PMDP Boards.	SMOs added.

Table 2 PMDP V4 Comments **Category**	**Comment**	**Resolution**
	Recommending, reviewing, and approval chain need to be more explicit. Centers need to also be the final approval authority for all except Level 4.	Clarifying the process and will be included in final version.
	Difference between entering PMDP and applying for certification is not explicit.	Clarifying difference and will be included in final version.
	Minimum level of training for each level is not specified for each level.	Training requirements being developed.
Other	Leadership doesn't care about PMDP, so why do it?	Leadership action plan and implementation plan will address this issue.
	Too many meaningless requirements.	Comment reflects an opinion: no action required.
	Signing up for programs is too much trouble, work requirements interfere, and the curriculum keeps changing.	Comment reflects an opinion: no action required.
	Develop a NASA APPL Practices and Principles Course that would instruct Level 1 and other participants on the PMDP.	Introduction to APPL materials being developed.
	Define testing requirements as appropriate for each Level.	Portfolio will cover requirements. APPL reviewing need and format of tests in curriculum.

Towards a Performance-Based Certification Program

A recent project management baseline study conducted by Interthink Consulting, Inc. (Mullaly, 2001) identified a number of key factors that are representative of organizations that are highly successful in managing projects throughout the project lifecycle. These factors include a formally established project management career path, an integrated curriculum and training program that supports the organization's processes and career development strategies, and a system that recognizes and rewards professional accreditation and advancement.

Hale (2000) points out that an organization considering a performance-based certification program should first develop a justification for the expenditure of resources (both money and people) to create and deploy such a program. Because certification programs often are established as a result of some specific problem, knowledge of the initial and long-term investments required to implement the certification program is also important so the cost of certification can be compared with the cost of alternative solutions to the problem. In making a case for certification, Hale points out that the question to be answered should ***not*** be framed as "Should people be qualified to do the job?" Rather, questions that drive the decision-making process are more informative if they address issues such as:

- Is certification the best way to make sure people are qualified or can perform to the same standard anywhere in the world?
- Is certification the best way to confirm that people are performing to standard consistently?
- Is certification the best strategy for accomplishing our goals?

A well-designed certification program identifies and describes who is to be certified by the program, the business needs that are driving the program, and the associated stakeholders. Hale (2000) has identified seven key elements that should be defined and developed for any certification program:

- *Certification requirements*: what people must do to become certified.
- *Program standards*: the program's assessment criteria, derived from job or task analyses and from inputs from key stakeholders.
- *Program tests*: the assessment methods that will be used to determine whether candidates have met the program standards, and how those methods will be created, administered, maintained and evaluated.
- *Preparation and remediation options*: the opportunities for training, education, apprenticeships, on-the-job experience, and other experiences that will be provided to help candidates meet the program's standards and fulfill requirements.
- *Governance body*: the group of individuals, such as a board of directors, that will provide oversight and stewardship, set policy on issues like appeals, re-certification, grandfathering and information disclosures, and evaluate the program's effectiveness.

- *Administrative practices*: how the program's assessment, record-keeping and reporting processes will be administered to eliminate bias, preserve confidentiality, and prevent misuse of test results.
- *Public relations and communications plan*: how information about the purpose, operating specifics, results and impact of the certification program will be disseminated to management, customers, employees and suppliers.

Based on this approach, NASA currently is well along the path to have a formal certification program available for program and project managers, *if it wants to go in that direction*. The groundwork for a NASA program/project manager certification process has been specified in the NIAT Report, which states that certification represents a more stringent and rigid application of professional development standards by requiring formal compliance of standards before an individual could be selected for a position, and that NASA recognizes both potential benefits and problems with certification, and that options for addressing certification will be analyzed and submitted to the NASA Chief Engineer for consideration prior to a decision on establishing certification by the Senior Management Council.

Figure 2 details an approach for establishing a performance-based program and project manager certification process that was adapted from Hale (2000), covering four phases involved in establishing a valid and reliable certification program:

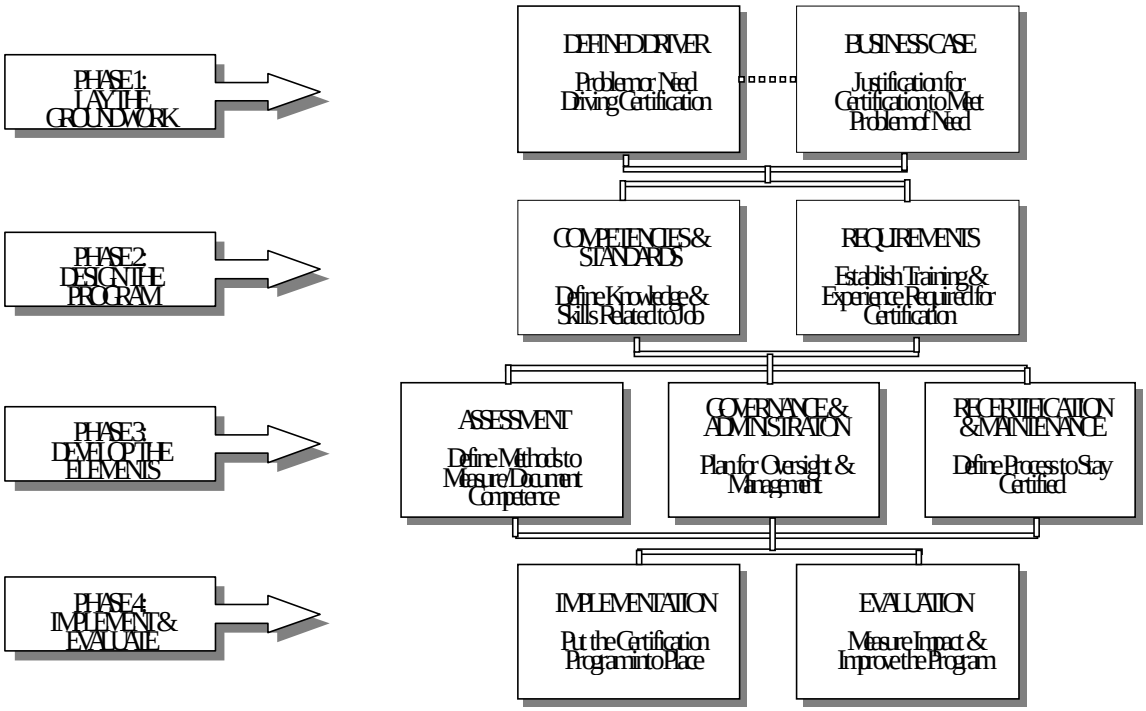

Figure 2: Approach to Establishing a NASA PM Certification Program

The redesigned PMDP Version 4.0 provides the competencies that can form the basis for a formal NASA project manage certification program. APPL also has in place an established curriculum that provides the training and directs other learning experiences necessary to attain the competencies. Therefore, if NASA chooses to proceed with a formal certification program, the process could begin at Phase 3 in the model.

The results and recommendations of the benchmarking study of certification programs across the public and private sectors are remarkably consistent with the previous discussion of competencies. Study respondents emphasized that the decision to go ahead with a formal certification program based on a set of specific competencies for a large, complex organization like NASA, IBM or Motorola is a major, serious decision in the history and culture of the organization. For certification to be successfully implemented and achieve the desired results, corporate or agency leadership must be ready to invest substantial time and money and lead a process of culture change. Substantial resistance must be expected, and leaders should have clearly in mind both the agency problem that formal certification will solve and how certification is likely to change the agency and its culture.

It may be that the purpose of project management, which is to release greater human and organizational potential by escaping from the rote rules and deadening routines of bureaucratic management, would be undercut by instituting more rules and general requirements for certification of project managers before they could function as project managers. Certification rules and practices may give assurance that all project managers in NASA at specific levels possess comparable qualifications, but some persons with leadership potential may find a formal certification process too constricting. Further, Downs (1967) reminds us that as bureaus and their leaders age, they will be tempted to institute rules for the sake of agency and career security:

> "As bureaus grow older they tend to develop more formalized rule systems covering more and more of the possible situations they are likely to encounter. The passage of time exposes the bureau to a wide variety of situations, and it learns how to deal with most of them more effectively than it did in its youth. The desire for organizational memory of this experience causes the bureau's officials to develop more and more elaborate rules. These rules have three main effects. First, they markedly improve the performance of the bureau regarding situations previously encountered, and make the behavior of each of its parts both more stable and more predictable to its other parts. Second, they tend to divert the attention of officials from achieving the social functions of the bureau to conforming to its rules --- the 'goal displacement' described by sociologists. Third, they increase the bureau's structural complexity, which in turn strengthens it inertia because of greater sunk costs in current procedures. The resulting resistance to change further reduces the bureau's ability to adjust to new circumstances. Consequently, older bureaus tend to be more stable and less flexible than young ones."

In interpreting the results and recommendations of the benchmarking study, attention should be paid to whether formal, universal, prior certification for project managers sacrifices too much of NASA's potential for change and adaptation to fast-changing circumstances in favor of perceived agency security. Would the problems created by certification be more or less serious than the existing problems meant to be solved by certification?

A review of the results of the Certification Benchmarking Study provides valuable advice from other public and private sector organizations that have attempted to define PM career development models. Table 3 on the following pages provides a comparison of the project manager training and certification processes that are used by the two Federal agencies and six private companies included in the benchmarking study. It is noteworthy that all agencies/companies in the sample implement the project manager certification organization-wide, although none of the organizations allow "grandfathering." Four of the six private companies have a mandatory certification process for their project managers. Although both Federal agencies currently encourage certification, they are working toward a mandatory requirement in the future. Half of the organizations surveyed have two or more levels of certification.

All organizations in the benchmarking sample indicated that they have, or are in the process of developing, agency or company-specific project manager competencies. In most cases the intent was to have an individualized internal certification process, although many of the organizations supported an equivalent external source such as PMI or DAU. In all cases, the Federal agencies and private companies have a formal training program in place to develop project managers and to serve their certification process. Several of the organizations also have policies on re-certification.

In describing the organizational project management development and certification process, the study found that the participating organizations were at various stages of maturity in their development and certification processes. Several programs were long-standing, but changes in terms of education, training, and experience criteria were an ongoing process for these organizations, and was often valued as a strategic imperative by senior management.

Table 3

Comparison of Project Manager Training and Certification Processes for Benchmarked Federal Government Agencies and Private Industry Companies

Organization	Range of Impact	Organizational Requirement	Levels of Certification	Certification Vehicles	Competency Definition	Collaboration	Curriculum Delivery
Federal Government Agencies							
Department of Defense (Defense Systems Management College	Entire Acquisition Corps organization	Certification required for selection of assignments and promotion	3 levels defined by DAU	Adopted DOD development and certification program	KSAs developed from Acquisition Corps requirements.	**NASA, DOE**	Residential Training and online
Navy Facilities Command				Currently identifying best practices in project management development & certification organization wide		**DSMC**	
U.S. Army Corps of Engineers				Several stand alone efforts within organization		**DSMC**	

Table 3

Comparison of Project Manager Training and Certification Processes for Benchmarked Federal Government Agencies and Private Industry Companies

Organization	Range of Impact	Organizational Requirement	Levels of Certification	Certification Vehicles	Competency Definition	Collaboration	Curriculum Delivery
General Services Administration	Entire Organization	Encouraged	One level Working on levels	Individual development plans Supports PMP	Skills and traits developed by GSA Project Manager Center for Expertise	HR (University for People)	Internal training Outsource vendors for instruction
Private Industry Companies							
Bechtel National Corporation	Entire Organization	Level 1 training required for all outside hires Level 2 required in the future	One level	None PMP supported	Competence based level 1 course	HR	Three levels of internal training
IBM Corporation	Entire Organization	Mandatory	3 levels	Internal and PMP (Level 3 only)	Multi-level competencies	Internal with HR	Residence Training

Table 3

Comparison of Project Manager Training and Certification Processes for Benchmarked Federal Government Agencies and Private Industry Companies

Organization	Range of Impact	Organizational Requirement	Levels of Certification	Certification Vehicles	Competency Definition	Collaboration	Curriculum Delivery
Lockheed Martin Corporation	Entire Organization	Qualified, certified and re-certified	One level	Internal experience summary submitted to a committee PMP and DOD Level III Certification accepted as equivalents	Entry and Qualification Basic Knowledge and Awareness Ability to perform with assistance Ability to perform without assistance Ability to advise and lead others		Experience and resident training
Motorola	Entire Organization	Desired	5 levels	Project management Professional (PMP) Collaboration with ESI and GWU (Certificates and Masters' Certificates)	Nine competencies and 12 general management competencies	ESI International George Washington University (GWU) (Master's degrees and certificates) PMI	Motorola University (residential workshops) Web based CD-ROM

Table 3

Comparison of Project Manager Training and Certification Processes for Benchmarked Federal Government Agencies and Private Industry Companies

Organization	Range of Impact	Organizational Requirement	Levels of Certification	Certification Vehicles	Competency Definition	Collaboration	Curriculum Delivery
URS Griner Corporation	Entire Organization	Working toward mandatory requirements	Not currently defined, but have defined two levels of capabilities (junior and senior)	None defined	Upcoming initiative to define competencies	Web authoring company	Free standing internally developed curriculum Web based training emphasized
United Services Automobile Association (USAA)	Proposed throughout entire organization (2001)	Encouraged	One level	PMP (optional)	Under development	Internal with HR	Internal and contracted

The agencies and corporations that participated in the benchmarking study were at various stages of maturity in their project management development and certification processes. Most were in early stages of developing competence-based project management education programs and related certification programs. Several certification programs were long-standing, but ongoing changes in terms of education, training, and experience continue, and both the programs and the changes were often valued as a strategic imperative by senior management. The new and incomplete character of several of the certification programs raises the question whether the perceived benefits of formal, universal certification are only hopeful expectations rather than being built on long experience.

A number of themes of project management development and certification programs emerged from the interviews conducted with the organizations in this study. First was the emphasis on a competency-based approach. All of the organizations relied on or were developing competencies of some sort as the basis of their PM development and certification efforts. Most of the organizations relied on external, partial, or test-based forms of competencies, unlike NASA' customized, performance-based and individualizable competencies. Second, career development rather than traditional training characterized the best development and certification programs.

Perceived Benefits:

- Performance is a discriminator in decision-making.
- Consistent and recognized definition of capability across the organization, and by industry and customers.
- Enhanced confidence in the capabilities of project managers.
- Consistency in what they can do and what they know.
- Common project management vision and language that can be used across the organization.
- Allows for keeping up with the rapid development of technology.
- Provides a foundation for effective project management development and mentoring, allows for the development of communities of practice and in turn develops a knowledge management infrastructure.
- Transforms the company to become project-based, well beyond simply running projects.
- Encourages the asking of hard questions in a non-attributional environment.
- Defines clear professional career paths for project management professionals.
- Achieves competitive advantage for individuals in terms of promotions and assignments.
- Provides an opportunity to add another dimension to recognition & retention programs.

- Benefits are clearly seen and supported by management and employees.
- Provides an effective basis to measure the project management skills and experience of individuals and organizations including external validation by organizations such as PMI.
- Provides higher capability in successfully managing critical projects for the company.

Problems for the Organization:

- Technical management requirements in functional areas are difficult to capture and time-consuming to define, with many similar concepts holding different names.
- It is difficult to define a common language and processes for a large number of people.
- Underestimation of the power of resident courses in creating and maintaining an effective culture. It is often sacrificed simply due to budgetary pressure and inability to quantify the difficult metrics of organizational impact of training.
- Mid-level bureaucrats are typically resistant.
- Continuing education requirements beyond the top level are usually non-existent.
- There is a tendency for over-reliance on tools rather than a true integration of the cultural and system element.
- Achieving buy-in at all organizational levels is a problem, where it is easier to intellectually agree but not truly support the effort.
- The mentality that a formalized project management development and certification process gets in the way of creative collaboration causes problems.
- Cross-company teams that involve management, technical, and project manager skills must resolve integration issues in career progression, with project management skills possibly cutting across functional areas.
- Organizational issues impact the practice of Project Management, such as centralized versus decentralized control, horizontal and vertical integration issues, and matrixed resources.
- Bureaucracy and administration requirements are a problem, making project management development and certification impossible.
- Management education on the project management development and certification process, with emphasis at the middle management level in overcoming reliance on intuition and gut feel.

- Creation of a trusting environment and encouraging management culpability in failures.
- Allowing project managers to be trained and certified.
- Use leaders' time to serve as teachers and mentors.
- The lack of a forcing function to make it happen.
- Very difficult to administer an effective program that does not have a centralized champion within the company ensuring that the program is meeting the objectives set out for it.
- People are accustomed to attending traditional training as a break from work, and now realize it is a different environment where performance is critical and will be measured.
- An organization that has undergone several significant reorganizations that have eliminated entire divisions, losing several significant improvements that never had a chance to come to fruition.
- Senior management tends to pull away and reassign personnel that show project management capability, thus removing talented people from managers who are left with a less-than-optimal view of developmental and certification activities.
- A problem with implementing a systematic project management development and certification program is that it simply takes time for project managers to learn and perform, and the organization is taking a risk in assigning new project managers. The organization must be tolerant of mistakes, and must build in safety nets, such as management emphasis on using organizational resources to solve project problems.

Recommendations from the organizations:

- Define common knowledge and common requirements across the entire organization and create strong competency frameworks.
- Careful and valid definition of the competency and capabilities and the requirements at each level. Development will naturally follow once a strong foundation has been created.
- Develop a competency-based project management development model.
- Create a strong competency-based training model.
- Standardize the language and project management processes as much as possible.
- The careful development of clear goals, roles, and responsibilities defined for both contractors and NASA.

Another theme was the finding that all organizations were either moving towards a formalized and rigorously defined project management assessment and certification program, or already possessed one. Assessment and certification was viewed as a management tool that allowed managers to have faith that a minimum level of capability is present and that a common language and set of tools is used across the project management workforce. The organizations varied in their levels of certification, use of external assessment and certification organizations and resources (such as PMI), the level of enforcement of assessment and certification standards, the definitions of various stages of certification and re-certification, and how equivalencies are defined and granted. The strongest programs had tailored their approach across different elements of the greater organization, and had devoted tremendous amounts of time and effort in collaborating with and updating the stakeholders. In terms of granting equivalencies for identified components of a development and certification model, all organizations permitted waivers and exceptions, but universally prevented grandfathering of experienced personnel into the programs. Grandfathering was seen as diluting the potential and cultural importance of the programs.

Recommendations:

- Plan towards mandatory certification
- Distinguish between qualification and certification, with the latter being advanced in nature.
- Adopt an existing career development process if possible, since all models tend to have common and already identified components
- Develop a project management career path that covers roles and responsibilities, rotation assignments, standard tools and techniques
- Practitioners must be educated about the level of commitment required.
- Prevent grandfathering, since it impedes the transmission of organizational culture. Carefully define equivalencies and exemptions with each component organization
- Carefully define equivalencies, but do not grandfather project managers. Offer fast start courses for more experienced Senior Management personnel to speed up the certification process

Executive-level support was a common thread across the organizations, but it did not necessarily come at the beginning of a PM development and certification program. In fact, most programs were started as pilot programs or voluntary efforts that eventually attracted the attention of senior management, beginning at a grass-roots level. When the programs achieved senior management visibility, the maturity of the process was sufficient to export across the greater organization. It is especially important to note that all organizations identified initial resistance to any perceived mandated developmental program, as well as ongoing resistance at middle management level. Small successes along the way ensured that the best programs were integrated into the culture of the

greater organization, and that the process owners were spread across the organization, incorporating the majority of functions.

Recommendations:

- High-level executive sponsorship.
- Obtain senior management sponsorship.
- Use a steering committee at senior management level to achieve continued emphasis.
- The creation of a total environment with a strong supporting structure is critical, to include tools and techniques.
- A systems approach integrating people, process, and tools should be emphasized as a major business transformation challenge.
- Tie the program to the strategic plan.
- Concentrate on culture change, or the effort will fail.

External resources such as PMI were identified as valuable in terms of organizing the body of knowledge required for project managers, but was deemed as only part of the solution. Several organizations supported external certification as part of their internal program, while others required an external certification at certain levels of their development model. Both approaches seemed to satisfy the respondent organizations, but extensive tailoring was accomplished in order to contextualize the competency model for the organization. The majority of organizations devoted resources for employees who wanted to pursue external certification, of which PMI was cited as the most popular alternative. All organizations cautioned that a certification program, such as the PMI PMP program, should be identified as only one part of a larger comprehensive PM development and certification approach for the organization. Many organizations make the mistake of trying to take the easy way out through a quick fix of requiring external certification.

Recommendations:

- Find a partner such as ESI International and George Washington University.
- Create strategic partnerships with external partners, such as universities, government agencies, and the private sector.
- Incorporate a strong team leadership component emphasizing Integrated Product Team processes, and train at the team level as part of the development process.

Integration into HR processes was deemed critical by all organizations. It seems that the tighter this integration was, the better the alignment of the organization in terms of strategic business goals. Zemke and Zemke (1999) specified that the decisive test for any type of competency development model is whether and how well the model fits into

the organization's performance management system. For the organizations in this study, this systems view of PM development and HR business processes is seen as an ongoing requirement in order to clearly articulate the relationship between job descriptions, recruiting of new personnel, retention of seasoned project managers, and proper compensation, incentives, and rewards for exceptional performance.

Recommendation:

- Full integration into Human Resources business processes.

Project management tools and techniques were seen as valuable elements of the programs studied, and the most successful programs attempted to field tools and techniques in parallel with the developmental and certification programs. Several organizations warned of the trap of using tools and techniques, such as an enterprise-wide PM Information technology system, as the definition of the total program. Education about emerging and new tools and techniques was also seen as a major element in any ongoing career development activity in terms of re-certification and continuing education.

Recommendations:

- Try to have tools available to roll out at the same time the methodology is rolled out, and keep putting more tools and content on the Web.
- Divisions such as IT will try to convince you that buying a good PM tool is all that is required for good project management. IBM almost fell into this trap.
- There is a tendency for over-reliance on tools rather than a true integration of the cultural and system elements.
- Leverage the Web as much as possible for training and tool delivery.
- Readily available training and tools.
- Carefully set criteria for outsourcing Web-based content.
- Use in-house subject matter experts to develop the content and outsource the Web formatting of the lesson plans.
- Achieve buy-in with all stakeholders early in the process.
- Integrate performance ratings and developmental plans.
- Try to establish a system that forces usage of materials.
- Carefully involve management in the development of the program and in the delivery.
- Balance Web-based elements with traditional resident training modules.
- Develop contractor and client contingency.

- Meaningful support and review process that discourages “dog and pony shows”.
- Use knowledgeable people.
- Make it supportive rather than audit.
- Rotation of individuals.
- Emphasize contract administration.
- Identify a strong process for change management because of the competing requirements during implementation, individual rice bowls, and major restructuring of business processes at this level. Manager’s Workshops are essential.
- As the process matures, other communities buy into the process, such as the consultant community and architect community for IBM.
- Knowledge management is also viewed as a giveback activity, and needs to be measured at a certifying board level.
- Develop trust and synergy through a systems approach.
- Communities of practice become increasingly important as the process matures, and maintain the momentum in changing from the prescriptive mode.

Mentoring was identified as a critical component of several programs. This was situated in the organization as giving back, and as a critical element in creating strong communities of practice and allowing for the transfer of best practices, leading to creation of a knowledge management framework. The mentoring activity was used as a feedback loop into these PM development and certification models, adding the value of perspective on successes and failures to the development of new project managers within the organizations in the study. The majority of organizations did not have a formal mentoring process in place that includes metrics on the effectiveness of their mentor.

Recommendations:

- Managers must be encouraged to embrace new behaviors, such as mentorship
- Mentoring is a key component of the process and needs to be measured as a giveback activity, reviewed at board level
- Include a strong mentoring capability

Table 4 provides a comparison of NASA’s progress toward a project manager certification process using the current PMDP with the level of development of the project manager certification processes identified for the organizations participating in the benchmarking study. NASA’s PMDP offers many of the necessary requirements for a certification process, including a competency-based model, a career development pathway and the training infrastructure within APPL. However, many of the required organizational components that are necessary for NASA to implement a formal

certification program, either at a center or Agency-wide, are currently at a developmental level.

Table 4
Comparison of NASA PMDP with Benchmarked Organizations

Requirements for a PM Certification Process	Organization	Level of Current Development
A. The development of a tailored PM competency-based development model		The organization is considering the development of a tailored PM competency model.
	GSA	The organization recognizes the importance of a tailored PM competency model, and is in the process of defining the components.
	Bechtel DOD IBM Lockheed Motorola URS USAA **NASA**	The organization possesses an operational tailored PM competency model.
B. Internal PM certification process	**NASA**	The organization is considering the development of a PM certification process.
	Bechtel GSA Motorola URS USAA	The organization is developing either a voluntary or mandatory PM certification process.
	DOD IBM Lockheed	The organization possesses an operational mandatory PM certification process.
C. Executive-level support for the PM development and certification model		The organization does not have executive-level support for the PM development and certification program.
	URS **NASA**	The organization has executive-level interest in a PM development and certification program.

Table 4
Comparison of NASA PMDP with Benchmarked Organizations

Requirements for a PM Certification Process	Organization	Level of Current Development
	Bechtel DOD GSA IBM Lockheed Motorola	The organization possesses the commitment and representation of executives for the PM development and certification program
D. Use of external PM development and certification resources		The organization is considering the inclusion of external resources.
	Bechtel Lockheed URS USAA **NASA**	The organization recognizes the importance of external resources, and uses them on a voluntary basis.
	DoD GSA IBM Motorola	The organization leverages external resources and applies them at specific levels and components of the PM development and certification program.
E. Integration into HR business processes	**NASA**	The organization is developing a PM development and certification program independent of the HR department.
	GSA URS USAA	The organization recognizes the importance of integration into the HR business processes, and is in the process of developing the working relationship.
	Bechtel DoD IBM Lockheed Motorola	The organization integrates the PM development and certification program into HR performance management business processes.
F. Issues concerning the granting of equivalencies		The organization does not have equivalencies and waivers defined.
	GSA URS USAA **NASA**	The organization is in the process of determining what the appropriate equivalencies and waivers should be at each level and component of the PM development and certification program.

Table 4
Comparison of NASA PMDP with Benchmarked Organizations

Requirements for a PM Certification Process	Organization	Level of Current Development
	Bechtel DoD IBM Lockheed Motorola	The organization possesses an operational system of definitions and processes for the granting of equivalencies and waivers.
G. Identification, development, and application of PM tools and techniques		The organization has not identified, developed, or implemented PM tools and techniques in a centralized, systematic fashion.
	DoD GSA IBM Lockheed Motorola URS USAA **NASA**	The organization is in the process of identifying, developing, and implementing PM tools and techniques.
	Bechtel	The organization fields PM tools and techniques in parallel with their PM development and certification program.
H. Implementation of a systems approach		The organization does not possess an integrated vision and plan of the interfaces required for the PM development and certification program.
	GSA URS USAA **NASA**	The organization is defining the interfaces required for their PM development and certification program.
	Bechtel DoD IBM Lockheed Motorola	The organization possesses an operational vision and definition of required interfaces for their PM development and certification program, and possesses an action plan to meet their needs.

Table 4
Comparison of NASA PMDP with Benchmarked Organizations

Requirements for a PM Certification Process	Organization	Level of Current Development
I. Use of mentoring.	URS	The organization is considering the development of a mentoring component for their PM development and implementation program.
	Bechtel DoD Lockheed USAA **NASA**	The organization recognizes the importance of mentoring, and is developing a voluntary mentoring component for their PM development and certification program.
	GSA IBM Motorola	The organization possesses an operational mentoring component, to include metrics.
J. Development of a knowledge management infrastructure.		The organization is considering the development of a knowledge management infrastructure to capture best and emerging practices.
	Bechtel DoD GSA IBM Lockheed URS USAA **NASA**	The organization is developing a knowledge management infrastructure for capturing best and emerging practices.

Table 4 **Comparison of NASA PMDP with Benchmarked Organizations**		
Requirements for a PM Certification Process	**Organization**	**Level of Current Development**
	Motorola	The organization possesses an operational knowledge management system that captures best and emerging practices.

Recommendations for Action

Based on this information, the following courses of action are recommended by NASA Academy, in consultation with the NASA Engineering Training Program (NET). This document represents an exhaustive analysis of the state-of-the-art in PM career development, and provides a clear roadmap for NASA to pursue an accurate PMDP model and a certification program, if desired.

Option 1:

Maintain status quo through continuation of the current voluntary status and structure of PMDP Version 4. The model will remain as only one way to develop PMs in NASA. Coordination for updates and assistance in usage of the materials will continue at

present levels, and usage and documentation will remain at the discretion of the individual participant.

Advantages:

1. No additional resource requirements.

This approach will allow NASA to accomplish voluntary compliance with the requirements generated in the PMDP.

2. Limits requirements on the project workforce.

Any approach toward certification using the PMDP model will require at least some individual effort. People will continue to need the time to document work experiences. Centers will need to establish time to review, assess, recommend and develop development strategies to map capability. However, there will be no requirements, so there will be no pressure.

3. No expectations to manage.

In a system without requirements and discipline, there is no standard to meet. The PMDP will remain as a voluntary program, and managers do not need to worry about managing employee expectations or requirements generated from project management career development issues.

4. No impact on selections for NASA programs and projects.

Managers will continue to be unconstrained in their selection of project managers or other project personnel. The PMDP will not provide mandatory input into this process.

Weaknesses:

1. Lack of discipline.

The greatest potential weakness of the current developmental system is that there are no agency standards applied to the selection and development of project managers using a standard Agency-wide approach. In an organization that spends billions of taxpayer dollars through the management of projects NASA's unsystematic approach can create the appearance of a significant problem. Beyond the appearance issues, the lack of discipline may result in selecting project managers who are unprepared in the methodology of project management, e.g. risk management, cost management, planning and scheduling. The lack of discipline to a defined process and model also prevents employees from clearly understanding what is expected of them if they want to be a project manager.

2. Ignores public reports.

In two of the four recent failure reports, findings encouraged NASA to consider some form of project manager certification. PMDP provides the infrastructure, but needs support and buy-in. Maintenance of the current approach ignores these recommendations. Furthermore, it is likely that future committee reports will continue to recommend some form of certification.

3. Lack of driving force for improvement.

This approach maintains the status quo and does not introduce a driving force for improvement in terms of project performance and project manager capability. All of the organizations in this benchmarking study are moving towards or already possess a mandatory and formal PM development and certification process. NASA is already halfway there with a robust PMDP model. The Benchmarking Study results reflect the fact that organizations make a conscious effort to improve in terms of project management capability, and that decision requires a commitment by the entire organization, not individual units or sectors.

4. Lack of agency integration and coordination.

The lack of a disciplined agency approach using PMDP as a foundation to certification will further encourage development of a disparate array of options used at the field center level. Continued divergence of Center approaches can undermine agency direction and waste resources through uncoordinated investment in capability development.

5. Inability to manage a critical community

The lack of recognized agency competency standards as reflected in the PMDP for the project management community may suggest an inability to collaboratively determine and manage requirements and standards.

Option 2:

Establish and aggressively promote the PMDP as the preferred NASA approach, with a final tailoring effort aimed at the Centers, functional offices, and SMOs, with a formal PMDP roll-out process implemented at the conclusion of the final update. Incorporate and promote PMDP certification as a desirable, but not mandatory, basis for selection.

Advantages:

1. Evolution of current process.

The current NASA PMDP is robust and strong. The weakness of the current system is based mostly on the lack of management emphasis and utilization of existing resources. A strong link between development and management direction would largely accomplish the benefits of full certification using the PMDP as the foundation. These revised PMDP competencies and upgraded courses lend themselves to voluntary use in selections and individual performance plans. NASA could elect to gradually incorporate these elements into existing management practices, avoiding the inevitable differences of opinion.

2. Limited additional resources.

Since the majority of costs to develop the career model and curriculum are sunk costs that are currently covered through the NASA Academy of Program Project Leadership (APPL), emphasis on the implementation of voluntary certification using the PMDP would limit the additional investments. Increased participation in the voluntary PMDP certification would, however, require additional investments in mentoring, administering, on the job training, and attendance of formal development events.

3. Limits resistance.

An evolutionary, voluntary PMDP certification approach would significantly eliminate resistance to change.

4. Builds on current grassroots support.

This approach builds on the current community of project practitioners who have received certification through the PMDP. A recent focus group of senior agency project practitioners strongly expressed the opinion that certification or training was necessary but not sufficient criteria for selection of project managers.

5. Establishes and promotes project manager certification consistent with industry trends.

The informal approach for PMDP relies on an evolutionary model for achieving broad certification. Over a period of time it is expected that a significant percentage of practitioners would be certified and the culture will enforce broader certification. NASA will come into alignment with many industry and government organizations that promote project management certification.

Weaknesses:

1. Potential for uneven implementation to reduce the effectiveness of certification.

Some individuals (as is currently the case) will significantly benefit from planned work experiences and development using the PMDP, while others will be told to forget about it and just do their jobs. Realization of the benefits of workforce development will continue to be a function of where one works and for whom one works, and the level of understanding that personnel possess of the PMDP.

2. Extends time by relying on management support and grassroots effort.

The evolutionary approach will take longer to achieve, if NASA is serious about PM certification using the PMDP. In our culture it is unlikely that all managers will be capable and/or motivated to support such a strategy. This will once again place the demand on the workforce to implement leader direction. Such an approach would work effectively only if Enterprise leaders and Center Directors are strongly supportive of using the PMDP.

3. Continues perceived void of leadership direction and failure to learn from past mistakes.

An evolutionary approach to project manager certification will be criticized in some quarters as indicating a lack of ability to make a definitive decision on PMDP certification and unwillingness to learn from past failures.

Option 3:

Develop and implement a NASA-mandated PMDP certification system, with specific requirements, standardized tools and techniques, and a centralized database of certified Project Managers that are to be used in selecting program or project managers, according to defined scope and resource allocation criteria. This program would be implemented within the time span of a mandatory transition window. Final tailored

adjustments would be made to the PMDP model for each Center covering functional office requirements and selections to programs and projects would not be made without PMDP certification.

Advantages:

1. Establishes unambiguous support for PMDP certification.

This approach maintains a level of consistency across NASA programs and projects, while addressing specific interests. As a result, this encourages buy-in to the PMDP certification activities by elements that have consistently perceived themselves as separate and distinct units.

2. Establishes NASA rigor and discipline.

A formal PMDP certification process will answer specifically what is expected of individuals who become project managers. Such an option would ensure at least minimal experience and educational standards for a workforce that is responsible for the majority of NASA's budget.

3. Consistent with external organizational trends.

As stated within the formal report, organizations that depend on project management are increasingly establishing standards associated with certification. The NASA PMDP model provides for a very effective system to manage the project management workforce. It is increasingly common for organizations to require certification before an individual can be selected to a position.

4. Addresses external expectations related to NASA project management.

NASA is considered one of the preeminent project organizations in the world. It is likely that there will be continuing pressures to ensure that NASA has a form of certification. In the event that NASA maintains the status quo the probability is high that NASA will eventually be forced into an externally mandated approach different than the PMDP.

Weaknesses:

1. Will require significant additional resources.

This approach takes time to work with each major internal stakeholder on developing a tailored PMDP model that will meet NASA requirements while addressing specific interests. Demand for required training and development experiences can be expected to increase, in some locations to a great degree. The results of this study indicate that this is the approach the majority of organizations implemented or desire to implement, but the time and effort expended are

significant for NASA. This approach also requires visible senior leadership emphasis and support in order to succeed.

2. Resistance will be greatest in this option.

Based on the discipline of this approach, it is likely to produce the greatest opposition. It will require the greatest change from the NASA norm. The introduction of mandatory criteria will necessarily limit management flexibility in selections. Many Centers have already begun or are thinking about developing their own competency models, independent of an overall Agency approach.

3. Demands addressing the issue of "grandfathering".

As has been pointed out throughout this report, a consistent finding has been the problems regarding "grandfathering" of experience and relating this to the PMDP benchmarks. Most organizations that established certification requirements indicated "grandfathering" was a mistake and should be avoided. Nonetheless, some process would need to be in place to accommodate the advanced experience level of many NASA practitioners so that they are placed at the appropriate level in the PMDP.

4. Danger of "box-checking" mentality.

A formal certification process using the PMDP is likely to create the potential for practitioners becoming more concerned with checking the box than with their professional development and preparation. There is a danger that the quality of development experience will fall victim to the quantity as demand for this experience grows. PMDP certification would have to be seen as a necessary but not sufficient form of capability.

5. Consideration would have to be given to potential legal and union issues.

It is critical to understand that an intensive effort and acceleration of current Academy activities will be required for *options 2 and 3*. These accelerated activities include:

- Development of a total systems approach to an online PMDP capability, to include online availability of job aids, an online expert system that guides users to appropriate PMDP content, and an online database of PMDP participants that outlines achievement and capabilities towards selection as program and project managers.
- Development of minimum requirements and equivalencies for each identified PMDP competency at each Center.
- Requires managers to create work positions to provide on-the-job experiences to support desired PMDP capabilities.

- Requires Enterprises to address and specify the desired number of PMDP-certified people in the requirements of new programs and projects.
- Requires the development and implementation of a more rigorous coaching and mentoring system at each Center to support PMDP activities.
- Positions will need to be competitively advertised, and PMDP certification requirements will need to be explicit.
- Consultation and tailoring of PMDP Version 4 will need to occur at Centers to ensure that competency models reflect unique capabilities and opportunities.
- Final buy-in and agreement on format and content, with a scheduled rollout and visible leadership emphasis and support.

APPENDIX 1 PMDP Review Participants

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APPENDIX 2 Email Requesting PMDP Review

From: nasapmdp [mailto:nasapmdp@nasaappl.com]
Sent: Tuesday, October 16, 2001 5:40 PM
To: nasapmdp-list@nasaappl.com
Subject: Request For PMDP Review

Dear Reviewers,

The purpose of this letter is to request your participation in the revalidation of the NASA Project Management Development Process (PMDP).

As you are aware, NASA's Academy of Program and Project Leadership (APPL) sponsors the PMDP, which emphasizes the practitioner aspect of developmental activities supplemented by academic materials.

In order for NASA to continue to provide the right developmental activities for the right people, the PMDP must be regularly updated so that it accurately reflects the developmental requirements of the Agency as a whole. APPL has decided to revalidate the current PMDP model that has been upgraded to Version 4. You are being asked to participate because of your experience in Advanced Project Management courses - you represent the best examples of subject matter experts within the Agency who possess the institutional knowledge in the specific areas of the PMDP.

There are three actions that must be accomplished by October 30, 2001. These actions pertain to the PMDP Guidebook and the previously delivered PMDP Wallchart. Both of these documents can now be retrieved online (see bottom of letter for details on how they can be accessed). NASA APPL will collect and dispose of all Agency comments pertaining to the PMDP that involve the following actions:

* Review each of the individual competencies for Levels 1, 2, 3, and 4 under each identified Job Performance Area with its associated Performance Goal, and recommend a minimum requirement and source (course, training, website, etc.) that should be implemented to achieve that specific Competency.
For example, under the Job Performance Area of Working in the NASA Environment to Achieve Goals and Continuously Improve, start with the Performance Goal of "Knows NASA's organization".... and follow the line to Level 1, Competency A at the bottom of the chart, "Has a basic knowledge of how NASA is organized"...; suggest a minimum requirement that would achieve this competency, such as reading the strategic plan, talking with senior managers, taking a NASA training program, etc.

* Review the NASA PMDP Handbook, pages 1-24, and submit comments on the PMDP process for purposes of completeness, accuracy, and clarity.

* Review the NASA PMDP Handbook, pages 25-135, and submit comments on the Competency Worksheets for tracking purposes.

The desired outcome of this revalidation effort is to create an online tool based on the printed materials that will allow managers and employees to access resources and updated materials to assist in the career development process. In order to automate this process, we need to ensure that the printed materials are useful and accurate.

We greatly appreciate your support of NASA's APPL and your continued willingness to improve the Agency in terms of project management expertise. Please call Tony Maturo at (757) 864-2590 or Jon Boyle at (202) 546-3466 if there are any questions pertaining to this activity.

Thank you,
Tony Maturo

INSTRUCTIONS

Please go to http://www.nasaappl.com/pmdp/index.html to access the PMDP Handbook and chart.
Username: nasapmdp
Password: approval01

Once you have completed your review, you may send feedback and comments to: pmdp@16by9studios.com

If you have any problems accessing information, please contact general@16by9studios.com

APPENDIX 3 Email Extending PMDP Review Period

From: nasapmdp [mailto:nasapmdp@nasaappl.com]
Sent: Tuesday, November 06, 2001 5:08 PM
To: nasapmdp-list@nasaappl.com
Subject: PMDP Review Period Extended

Dear Reviewers,

I am pleased to inform you that the review period for the revalidation/update of the NASA APPL Project Management Development Process (PMDP) has been extended. NASA APPL will now collect comments from across the Agency up until November 15, 2001.

You are kindly asked to complete the following three actions by that date:

1) Review each of the individual competencies for Levels 1, 2, 3, and 4 under each identified Job Performance Area, referring to its associated Performance Goal, and recommend a minimum requirement and source (course, training, website, etc.) that must be implemented to achieve each competency.

For example, under the Job Performance Area of Working in the NASA Environment to Achieve Goals and Continuously Improve, find the Performance Goal "Knows NASA's organization..." and then follow the line to Level 1, Competency A at the bottom of the chart, where it says, "Has basic knowledge of how NASA is organized." Suggest a minimum requirement that would achieve this competency: reading the strategic plan, talking with senior managers, taking a NASA training program, what have you.

2) Review the NASA PMDP Handbook, pages 1-24, and submit comments on the PMDP process with regard to completeness, accuracy, and clarity.

3) Review the NASA PMDP Handbook, pages 25-135, and submit comments on the Competency Worksheets for tracking purposes.

These actions require the PMDP Guidebook and PMDP Wallchart. Both of these documents can be retrieved online (see below for how they can be accessed).

We greatly appreciate your support of NASA APPL and your continued willingness to improve the Agency in terms of project management expertise. Please call Tony Maturo at (757) 864-2590 or Jon Boyle at (202) 546-3466 if you have any questions.

Thank you,
Tony Maturo

INSTRUCTIONS:
Please go to http://www.nasaappl.com/pmdp/index.html to access the PMDP Handbook and chart (or go to the APPL site www.appl.nasa.gov).
Username: nasapmdp
Password: approval01
Once you have completed your review, you may send feedback and comments to: pmdp@16by9studios.com If you have any problems accessing information, please contact general@16by9studios.com

APPENDIX 4 References

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